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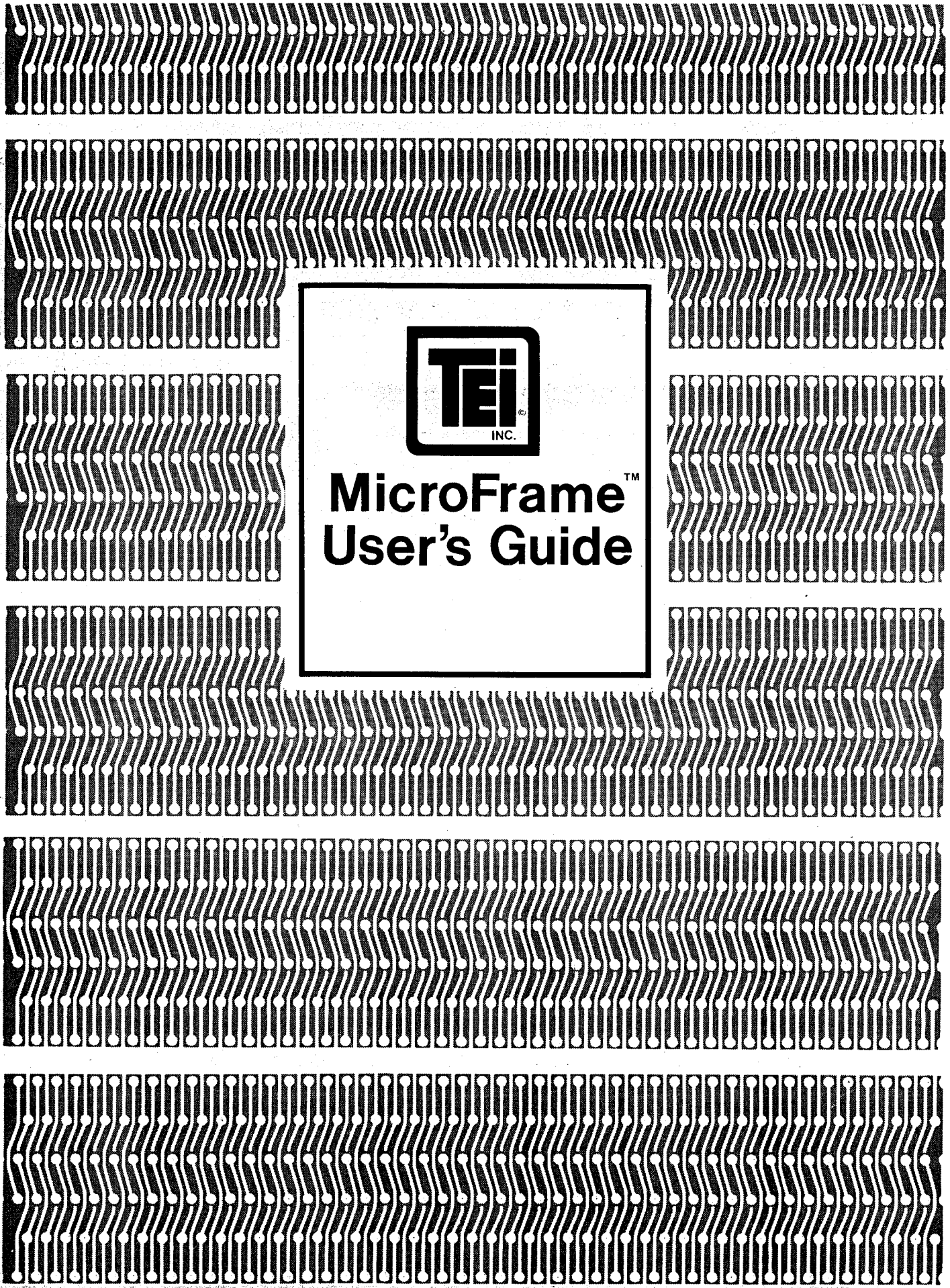

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Part Number 13691-02

Specifications subject to change without notice.

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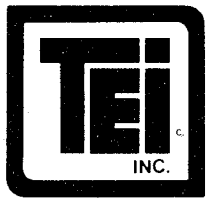

MicroFrame™

User's Guide

MicroFrame^{tm} Mainframe Users Guide

Original Issue October 1981

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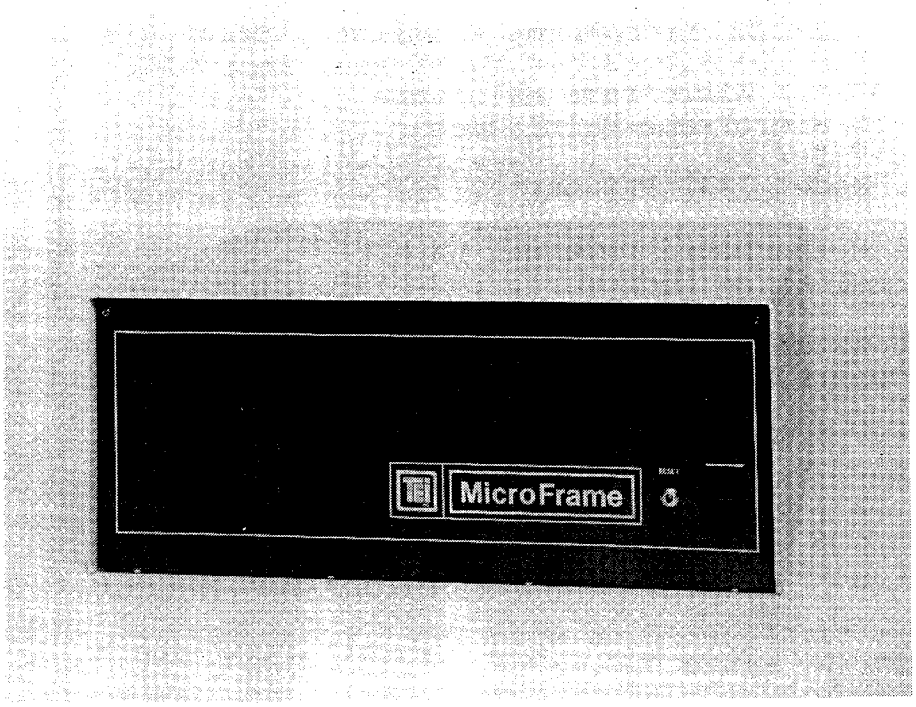

Figure 1-1 TEI, Inc. MCS-122 MicroFrame Mainframe, Front View

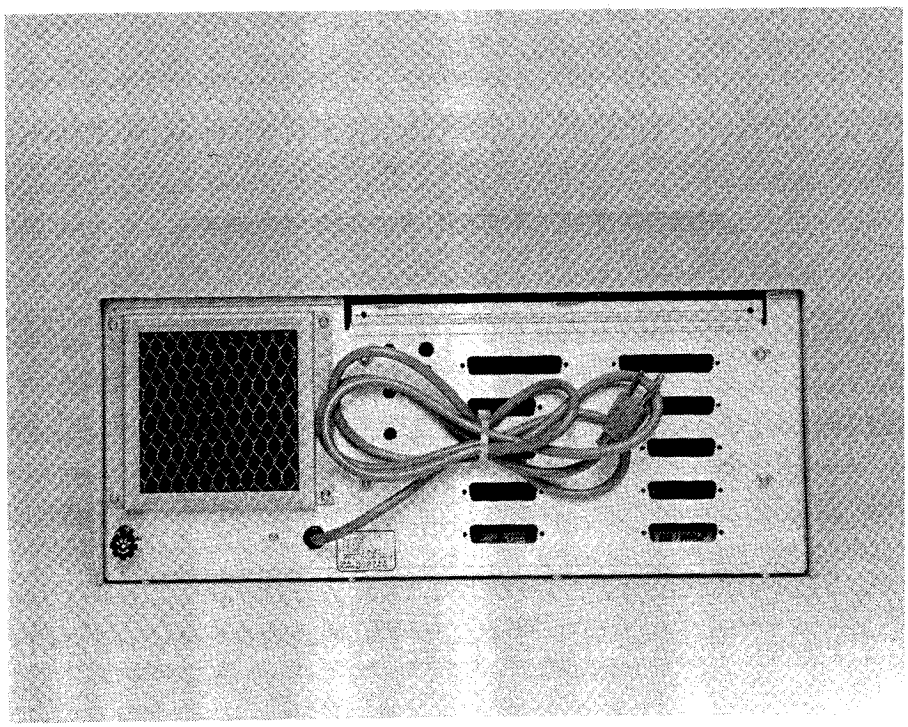

Figure 1-2 TEI, Inc. MCS-122 MicroFrame Mainframe, Rear View

SECTION I

INTRODUCTION

1.1 GENERAL

Your TEI, Inc. MicroFrame^{tm} Mainframe family members are the best microcomputer mainframes on the market today. This manual contains installation, operation, and maintenance procedures to help you obtain maximum benefit from these fine machines.

Each MicroFrame Mainframe has the following features:

+ Industrial-quality, fan-cooled, fused, power supply driven by a constant-voltage (ferroresonant) transformer for increased reliability and for immunity from power line noises, "brownout", and voltage surges. For over a decade, TEI has manufactured and sold thousands of these CVT-based power supplies -- the same proven power-supply technology incorporated in your TEI MicroFrame -- to customers that required the finest in regulated power supplies.

+ Fiberglass S-100 motherboard with shielded etched-circuit conductors, active termination, factory-installed gold-plated connectors, screw terminals for power-supply connections, keyed connector for dedicated systems, and provision for an S-100 bus front panel. Fully compatible with IEEE 696 S-100 bus standard.

+ Industrial-quality, heavy-gauge sheet-metal components: chassis, panels, and case, fabricated by automated machinery in TEI's own metal shop.

1.2 DESCRIPTION

The MicroFrame Mainframe family consists of 12-card capacity Mainframes MCS-112, RF-12, RM-12, and TF-12; and 22-card capacity Mainframes MCS-122 and RM-22.

1.2.1 MCS-112/MCS-122 MICROFRAME MAINFRAMES (Figures 1-1,1-2)

The MCS-112 MicroFrame (Mainframe Computer System, 12-card version) and MCS-122 MicroFrame (22-card version) are designed for desk or table-top applications. These machines are similar except in length, number of connnectors, and power-supply capabilities.

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1.2.2 RM-12/RM-22 MICROFRAME MAINFRAMES (Figure 1-3)

Each RM-12 MicroFrame (Rack-Mounted, 12-card version) or RM-22 MicroFrame (22-card version) is electrically and functionally identical to the corresponding MCS MicroFrame. Physically, RM units have slide brackets and a 19-inch front panel for mounting in a standard 19-inch RETMA rack; and are made of heavier-gauge sheet metal for performance in industrial environments and vibration-prone installations.

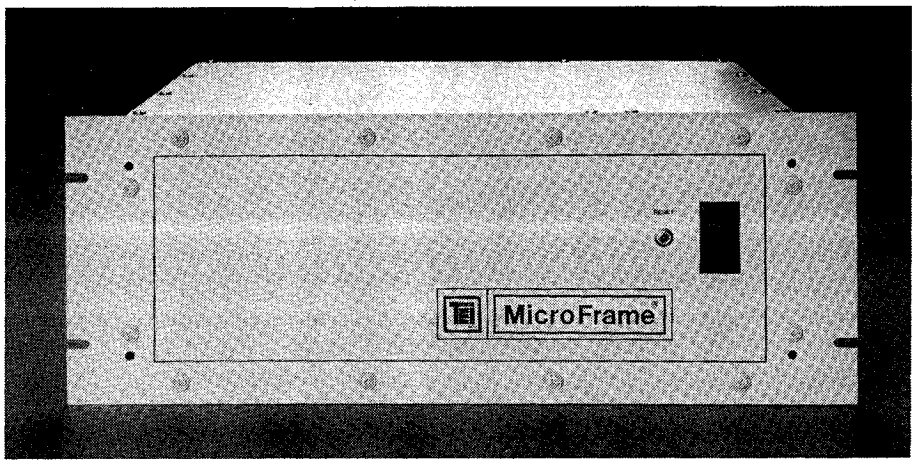


Figure 1-3 TEI RM-12 MicroFrame Mainframe

1.2.3 TF-12/RF-12 MICROFRAME MAINFRAMES (Figure 1-4)

The TF-12 MicroFrame (Twin Floppy Disk Computer System, 12-card version) was designed for desk or table top applications where space is limited. The TF-12 is functionally and dimensionally equivalent to the MCS-112 MicroFrame, but the cabinet also contains power supplies and mounting arrangements for customer-supplied 5.25" diskette drives. Unless otherwise specified, the TF-12 is supplied with two front-panel drive cutouts.

The RF-12 MicroFrame is similar, but, like the RM series, is designed for rack-mounting.

TEI can supply a blanking plate to cover one cutout, if only one drive used. TEI can also, on special order only, supply the TF or RF-12 to accomodate three drives.

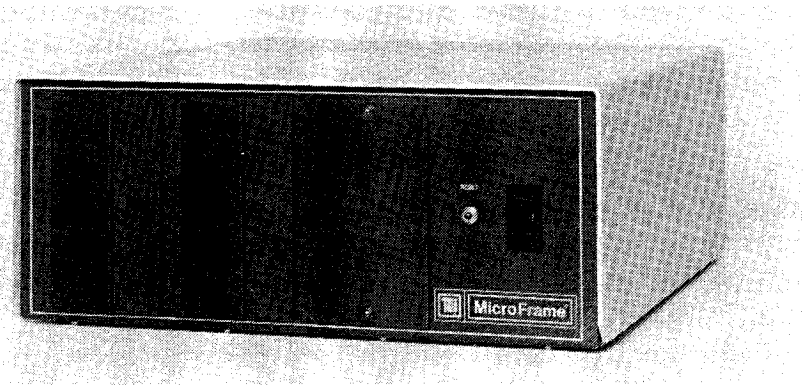


Figure 1-4 TF-12 MicroFrame Mainframe

1.3 TEI, INC. MICROFRAME FAMILY PERIPHERAL EQUIPMENTS

1.3.1 DISKFRAME^{tm} SERIES DUAL DISKETTE DRIVES (Figure 1-5)

The DiskFrame cabinet mounts two 8" diskette drives side-by-side. The cabinet also contains a TEI industrial-quality power supply with constant-voltage transformer.

A DFD-0 Unit consists of just this cabinet, with no drives supplied. A DFD-80 Unit consists of the DiskFrame cabinet and two single-sided 8" drives that can read or record single- or double-density data. Each drive can store up to 391K (K = 1024) bytes (single-density, unformatted) or 781K bytes (double-density, unformatted).

A DFD-82 Unit consists of the DiskFrame cabinet and two double-sided 8" drives. Each drive can store up to 800K bytes (single-density, unformatted), or 1600K bytes (double-density, unformatted).

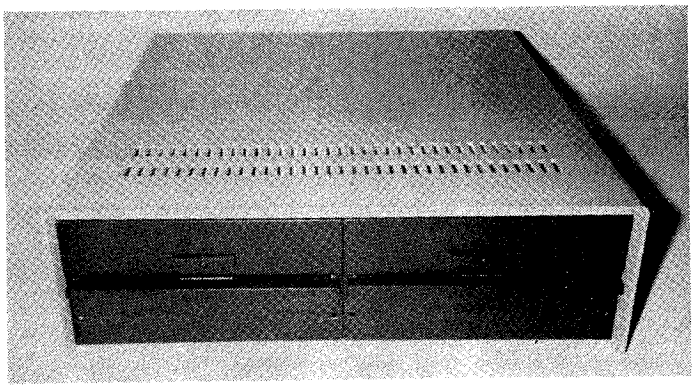


Figure 1-5 DiskFrame^{tm} Series

1.3.2 PRINTER (Figure 1-6)

The TEI Model 3432 Printer offers continuous printing of any combination of upper and lower case characters at a speed of 150 characters per second on continuous forms at six or eight lines per inch. The Model 3432 Printer is built into an attractive lowboy enclosure for paper storage and noise reduction.

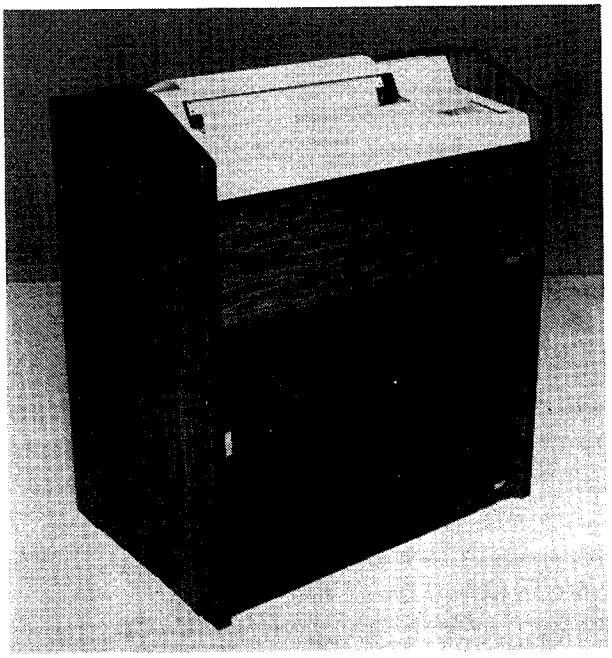


Figure 1-6 TEI, Inc.
Model 3432 Printer

1.4 SPECIFICATIONS

1.4.1 ELECTRICAL

1.4.1.1 All Units

S-100 Bus Active Termination	Each input connected to regulated +2.4 VDC source through 180 ohms
S-100 Bus Driver Requirements	Must sink approximately 13 mA ($I_{OL} \geq 13$ mA)
Line Noise Rejection	90 dB
Input AC Range	70 - 140 VAC, 60 Hertz (Domestic Systems); 140 - 240 VAC, 50 Hertz (International Systems). Dedicated line NOT required.

1.4.1.2 Models MCS-112, RM-12

AC Input	3.5A (Domestic Systems); 1.75A (International Systems).
DC Output(1)	+8 VDC @ 17A +16 VDC @ 2A -16 VDC @ 2A

1.4.1.3 Model MCS-122, Model RM-22

AC Input	8.9A (Domestic System); 4.5A (International System).
DC Output(1)	+8 VDC @ 30A +16 VDC @ 4A -16 VDC @ 4A

1.4.1.4 Model TF-12, RF-12

AC Input	8.9A (Domestic System); 4.5A (International System).
DC Output(1)	+ 5 VDC @ 1A (Each, three outputs) + 8 VDC @ 15A +12 VDC @ 1A (Each, three outputs) +16 VDC @ 2A -16 VDC @ 2A.

---

(1) Voltage levels nominal

1.4.2 DIMENSIONS

Height x Width x Depth, inches (centimeters):

Model MCS-112	7.25 x 17.25 x 12	(18 x 44 x 30)
Model MCS-122	7.25 x 17.25 x 19.5	(18 x 44 x 50)
Model RF-12	7 x 19 x 13	(17 x 48 x 33)
Model RM-12	7 x 19 x 13	(17 x 48 x 33)
Model RM-22	7 x 19 x 19.5	(17 x 48 x 50)
Model TF-12	7.25 x 17.25 x 12	(18 x 44 x 30)

Rack Depths:

RM-12, RF-12	13" (33 cm) with #13926-01 bracket (standard); 22"(55 cm) with #13926-02 bracket.
RM-22	19.5" (50 cm) with #13926-01 bracket (standard); 28"(70 cm) with #13926-02 bracket

Shipping Weights(2):

MCS-112	30 lbs (13.6 kg)
MCS-122	45 lbs (20.5 kg)
RF-12	42 lbs (19 kg)
RM-12	35 lbs (15.9 kg)
RM-22	55 lbs (25 kg)
TF-12	37 lbs (16.8 kg)

---

(2) Equipments packed in foam. Weight may vary ±3 lbs (1.1 kg) with density of foam.

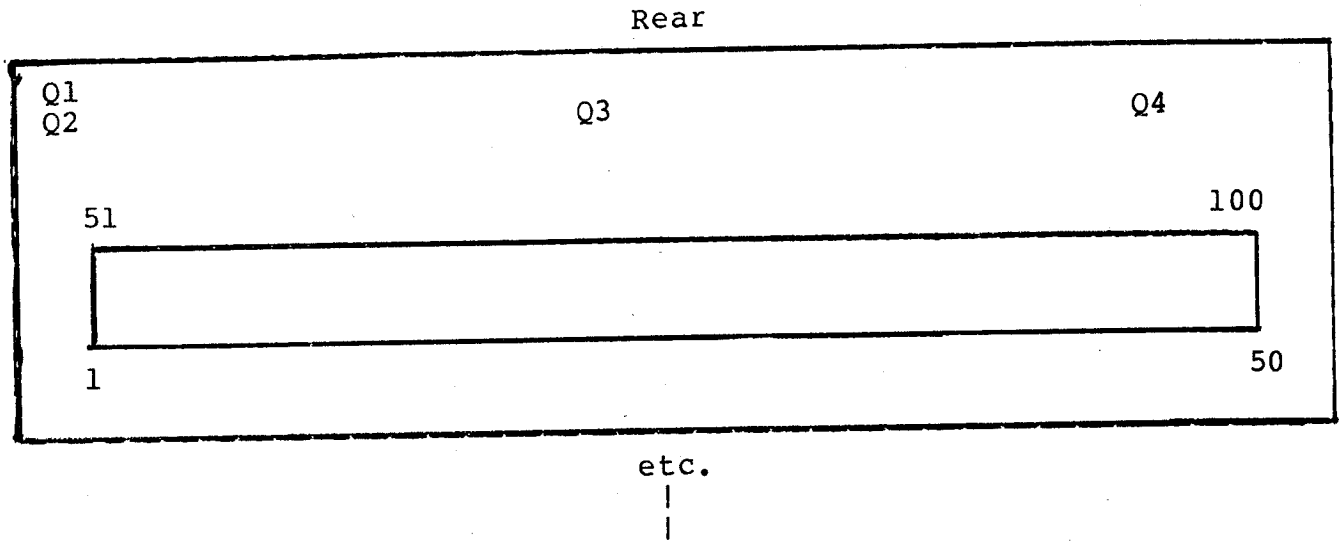


Figure 2-1 S-100 Bus Motherboard Physical Layout

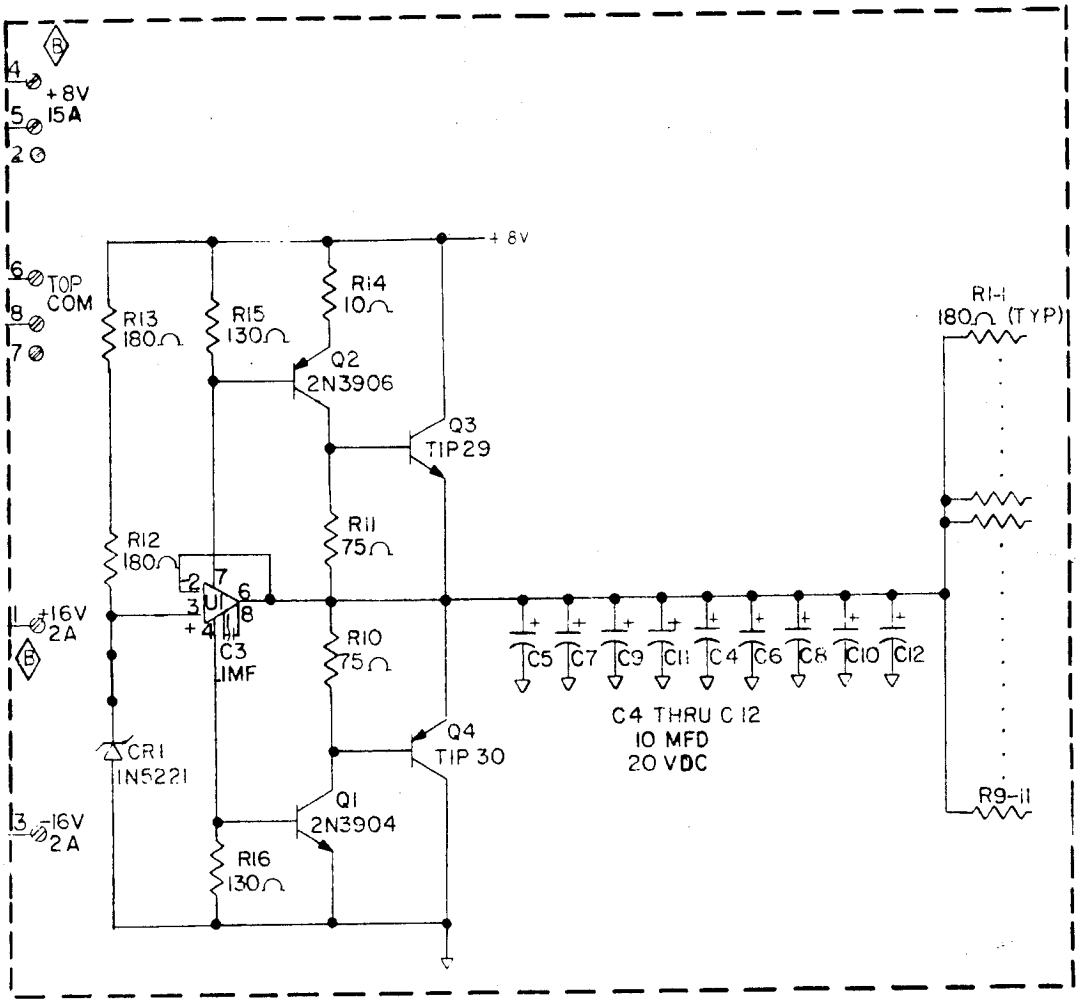


Figure 2-2 Active Termination Logic

SECTION II

S-100 BUS

2.1 GENERAL

The S-100 bus is an arrangement of 100 conductors that carries power between the Computer cards that plug into the bus, and the MicroFrame power supply; and address, data, and control signals between the Computer cards.

2.2 MOTHERBOARD

2.2.1 GENERAL

The wiring layout combines the noise reduction of twisted-pair wiring with the reproducibility and reliability of etched-circuit wiring. All signal inputs connect to an active-termination circuit for further noise reduction. The S-100 Bus sockets have gold-plated contacts for highest reliability.

2.2.2 PHYSICAL LAYOUT (Figure 2-1)

Looking at an S-100 Bus Motherboard with its active-termination components to the rear, each socket has pins 1-50 on the front side (side that will be plug-in card's component side, for TEI cards) with pin 1 to the left and pin 50 to the right.

Pins 51 to 100 run from left to right on the back side (side that will be plug-in card's wiring side, for TEI cards), with pin 51 directly behind pin 1 and pin 100 directly behind pin 50.

2.2.3 ACTIVE TERMINATION LOGIC

The active termination logic (Figure 2-2) acts like an electronic voltage regulator to maintain the voltage reference for signal-termination resistors R1-1 through R9-11 at approximately +2.4 VDC.

Each input is terminated by 180 ohms. This requires that line drivers be able to sink 2.4 VDC/180 ohms = 13 milliamperes; that is, the driving device must have $I_{OL} \geq 13$ milliamperes.

In operation, R12, R13, and CR1 set a reference level of +2.4 VDC at the noninverting input of voltage-follower U1. The nominal 2.5 mA supply current for U1 produces about 0.3 VDC drop across R15 and R16. This biases complementary transistor pair Q1 (NPN) and Q2 (PNP) for about 10 mA of current through R10 and R11.

Since R10 and R11 have the same nominal value, 10 mA sets the base of Q3 at about +3.1 VDC and the base of Q4 at about +1.7 VDC. Q3 and Q4, complementary power transistors (Q3, NPN; Q4, PNP) connected as emitter followers, conduct to maintain the output level near +2.4 VDC.

If current through R10 and R11 increases, the base-emitter voltage of Q3 and Q4 rises. This causes Q3 to conduct more, Q4 to conduct less. The resulting output voltage remains near +2.4 VDC. If current decreases, Q3 conducts less and Q4 conducts more; again, to keep the output voltage constant.

2.3 POWER CONNECTIONS

The MicroFrame series of S-100 Bus equipments supplies +8 VDC on pins 1 and 51, +16 VDC on pin 2, -16 VDC on pin 52, and ground on pins 50 and 100.

For current ratings, refer to Section 1.4.

2.4 SIGNAL DEFINITIONS

Refer to documentation for the card set you are using. TEI MicroFrames supply +2.4 VDC (nominal) from the active-termination logic on each S-100 bus pin except pins 1, 2, 50, 51, 52, and 100 (power) and pin 75 (Reset).

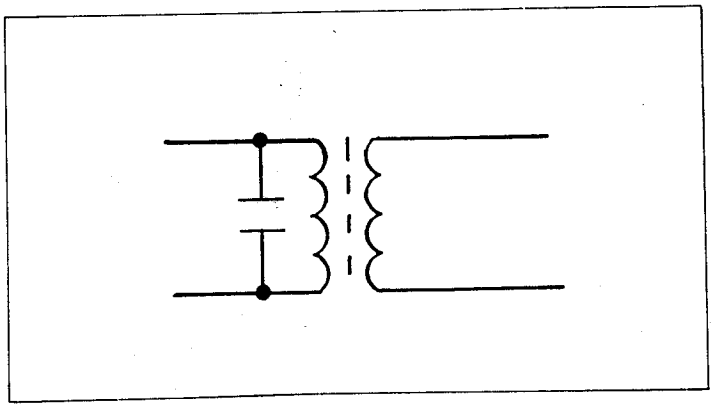


Figure 3-1 Typical Constant-Voltage Transformer Circuit

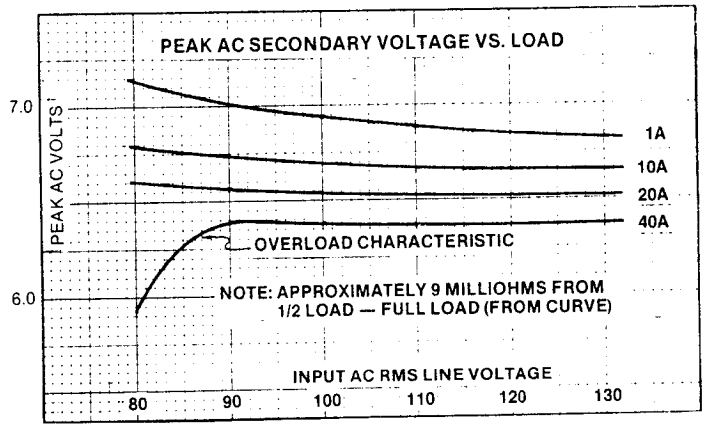


Figure 3-2 Typical Constant-Voltage Transformer Output Levels

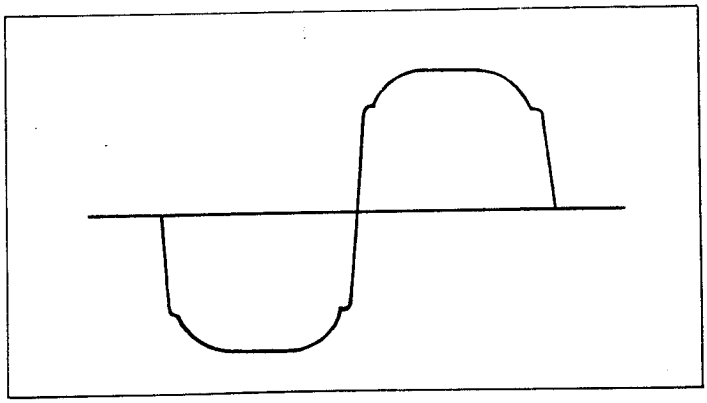


Figure 3-3 Typical Constant-Voltage Transformer Output Waveform

SECTION III

POWER SUPPLIES

3.1 GENERAL

The power supplies in the MicroFrame Mainframes are industrial-quality, fan-cooled, fused units designed to Underwriters Laboratory #478 standards.

The power supplies are similar, except that the MCS-122 supply is designed for higher current output.

3.2 CONSTANT-VOLTAGE TRANSFORMER

Each power supply uses a constant-voltage (ferroresonant) transformer. In operation, the secondary winding of this transformer saturates the transformer core during that part of each half-cycle that the primary voltage is higher than about 40 VAC. Transformer construction is such that the primary does not saturate.

Capacitor C1 (Figure 3-1) charges from the beginning of each half-cycle until the core begins to saturate. As the core saturates, the winding inductance drops rapidly, which discharges C1. Its discharge current further saturates the core.

When C1 completely discharges, the energy stored in the winding recharges it, but in the opposite direction. As the capacitor charges, its voltage rises, which causes the winding to come out of saturation. The winding inductance rises, current falls, etc., until the winding comes completely out of saturation.

The transformer winding and capacitor value are selected such that this process repeats as long as power is applied. Figure 3-2 shows how well this CVT action regulates voltage.

A CVT offers several advantages in addition to straight voltage regulation. First, since the core is saturated, voltage spikes present on any AC line cannot pass through to damage the power supply or the equipment. Secondly, the energy stored in the saturated core and the constant-voltage output even at a very low input voltage protects against "brownout's".

The rapid capacitor charge-discharge along with the constant-voltage output combine to create a very nearly square-wave output waveform (Figure 3-3). This waveform improves equipment operation by reducing filter capacitor "ripple" (ratio of peak to average) current because the power supply rectifiers conduct over a larger part of each half-cycle. Since the heating caused by ripple current is a killer of filter capacitors, CVT input increases capacitor life by up to 40%.

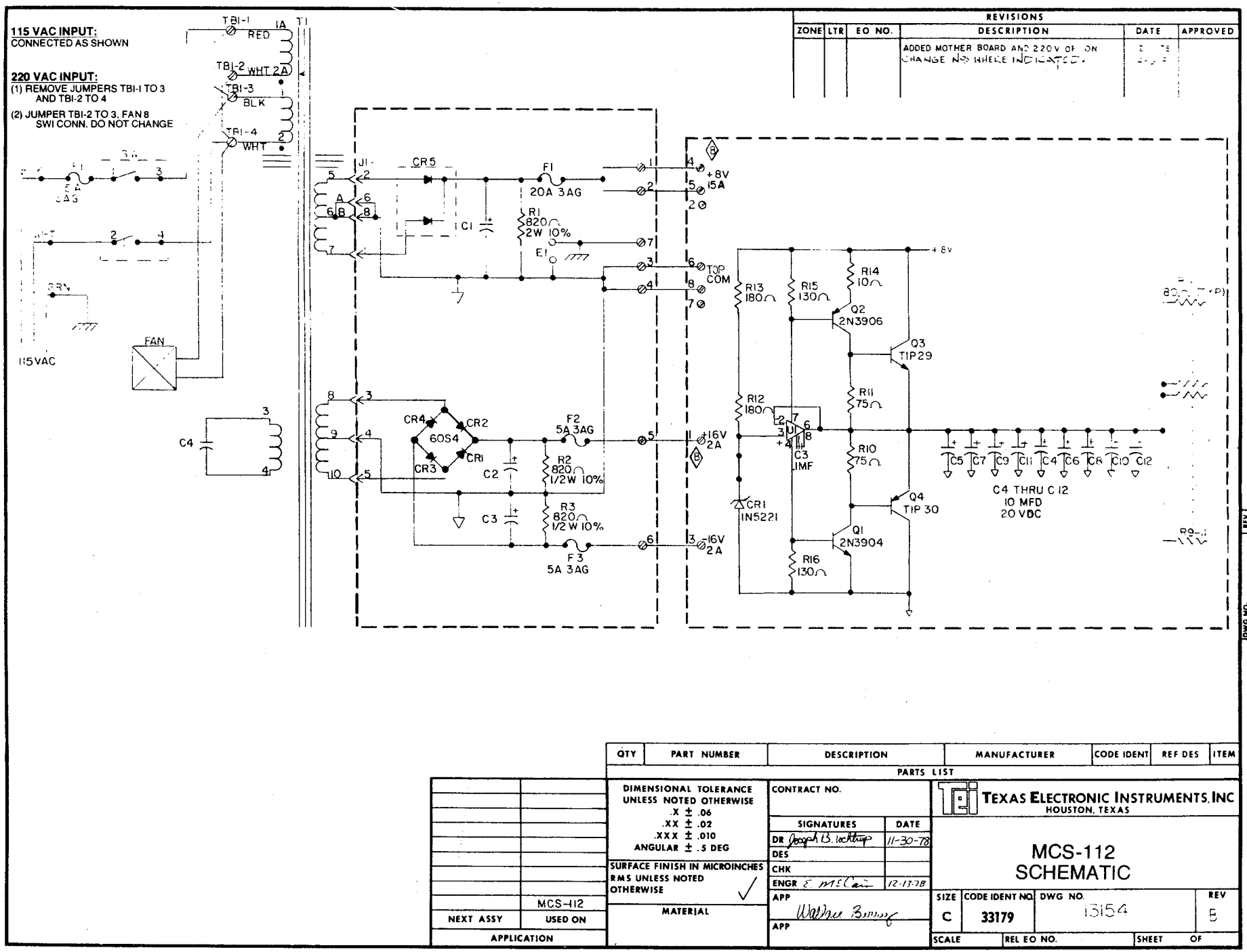


Figure 3-4 MCS-112/RM-12 Schematic Diagram (Drawing 13154)

3.3 SCHEMATIC DIAGRAM DISCUSSION

3.3.1 MCS-112/RM-12 (Figure 3-4)

3.3.1.1 AC Input

T1 is the constant-voltage transformer. C4, connected across an auxiliary winding that permits a smaller value at a higher voltage, is the CVT capacitor. The dual primary windings permit 110-VAC operation for domestic systems, or 220-VAC operation for international systems. The fan motor is connected to always run at 110 VAC.

SW1 is the Power switch. F1 protects the transformer.

3.3.1.2 13120 Power Supply Motherboard

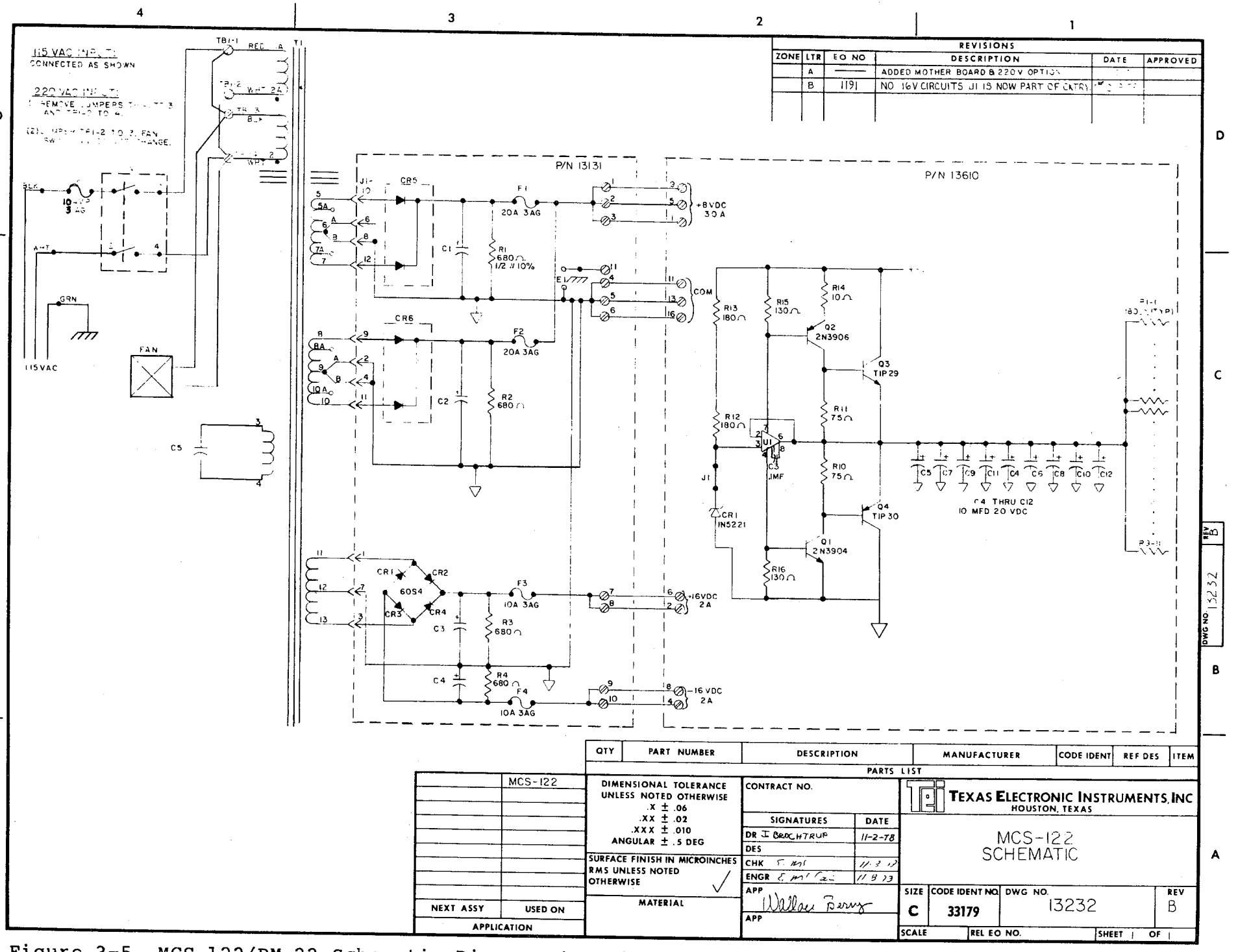
The 13120 Power-Supply Motherboard is used in the MCS-112 and RM-12 equipments.

+8 VDC Supply. The +8 VDC supply uses full-wave diode module CR5, filter capacitor C1, and bleeder resistor R1. This supply is fused at 20 amperes by F1.

±16 VDC Supply. The ±16 VDC supply uses CR1-CR4 connected as a bridge rectifier, filter capacitors C2 and C3, and bleeder resistors R2 and R3. F2 fuses the +16 VDC supply and F3 fuses the -16 VDC supply, each at 5 amperes.

3.3.1.3 13260 S-100 Bus Motherboard

The S-100 Bus Motherboard has the active termination logic described in Section II.



QTY	PART NUMBER	DESCRIPTION	MANUFACTURER	CODE IDENT	REF DES	ITEM

PARTS LIST

MCS-122

NEXT ASSY | USED ON

APPLICATION

DIMENSIONAL TOLERANCE UNLESS NOTED OTHERWISE
.X ± .06
.XX ± .02
.XXX ± .010
ANGULAR ± .5 DEG

SURFACE FINISH IN MICROINCHES RMS UNLESS NOTED OTHERWISE ✓

MATERIAL

CONTRACT NO.

SIGNATURES	DATE
DR J BRECHTRUP	11-2-78
DES	
CHK	
ENGR	
APP Wallace Berry	
APP	

TEXAS ELECTRONIC INSTRUMENTS, INC
HOUSTON, TEXAS

MCS-122
SCHEMATIC

SIZE	CODE IDENT NO.	DWG NO.	REV
C	33179	13232	B

SCALE | REL EO NO. | SHEET 1 OF 1

Figure 3-5 MCS-122/RM-22 Schematic Diagram (Drawing 13232)

3.3.2 MCS-122/RM-22 (Figure 3-5)

The MCS-122/RM-22 MicroFrame power supply is similar to the MCS-112/RM-12 power supply, except that it has two +8 VDC supplies connected in parallel to meet the heavier current demand presented by the increased number of cards.

3.3.2.1 **AC Circuitry**

T1 is the constant-voltage transformer. C5 is the CVT capacitor. The dual primary windings permit 110-VAC operation for Domestic systems, or 220-VAC operation for International systems. The fan motor runs from 110 VAC in either application.

T1 has two secondaries for the +8 VDC supply. Each secondary has a tap at one turn from each end, in addition to the center-tap. Use the full winding for higher voltage, the taps for higher current. Since June, 1981, all units are shipped from the factory with the taps connected. Refer to Section A.3 for details on changing the wiring, if necessary.

SW1 is the Power switch. F1 protects the transformer.

3.3.2.2 **13130 Power Supply Motherboard**

The 13130 Power-Supply Motherboard is used in the MCS-122 and RM-22 equipments.

+8 VDC Supply. The +8 VDC supply is essentially two of the supplies found on the 13121 motherboard. Each supply uses a full-wave diode module (CR5,CR6), filter capacitor (C1,C2), and bleeder resistor (R1,R2). Each supply is fused at 20 amperes (F1, F2).

±16 VDC Supply. The ±16 VDC supply uses CR1-CR4 connected as a bridge rectifier, filter capacitors C3 and C4, and bleeder resistors R3 and R4. F3 fuses the +16 VDC supply and F4 fuses the -16 VDC supply, each at 10 amperes.

3.3.2.3 **13260 S-100 Bus Motherboard**

The S-100 Bus Motherboard has the active termination logic described in Section II.

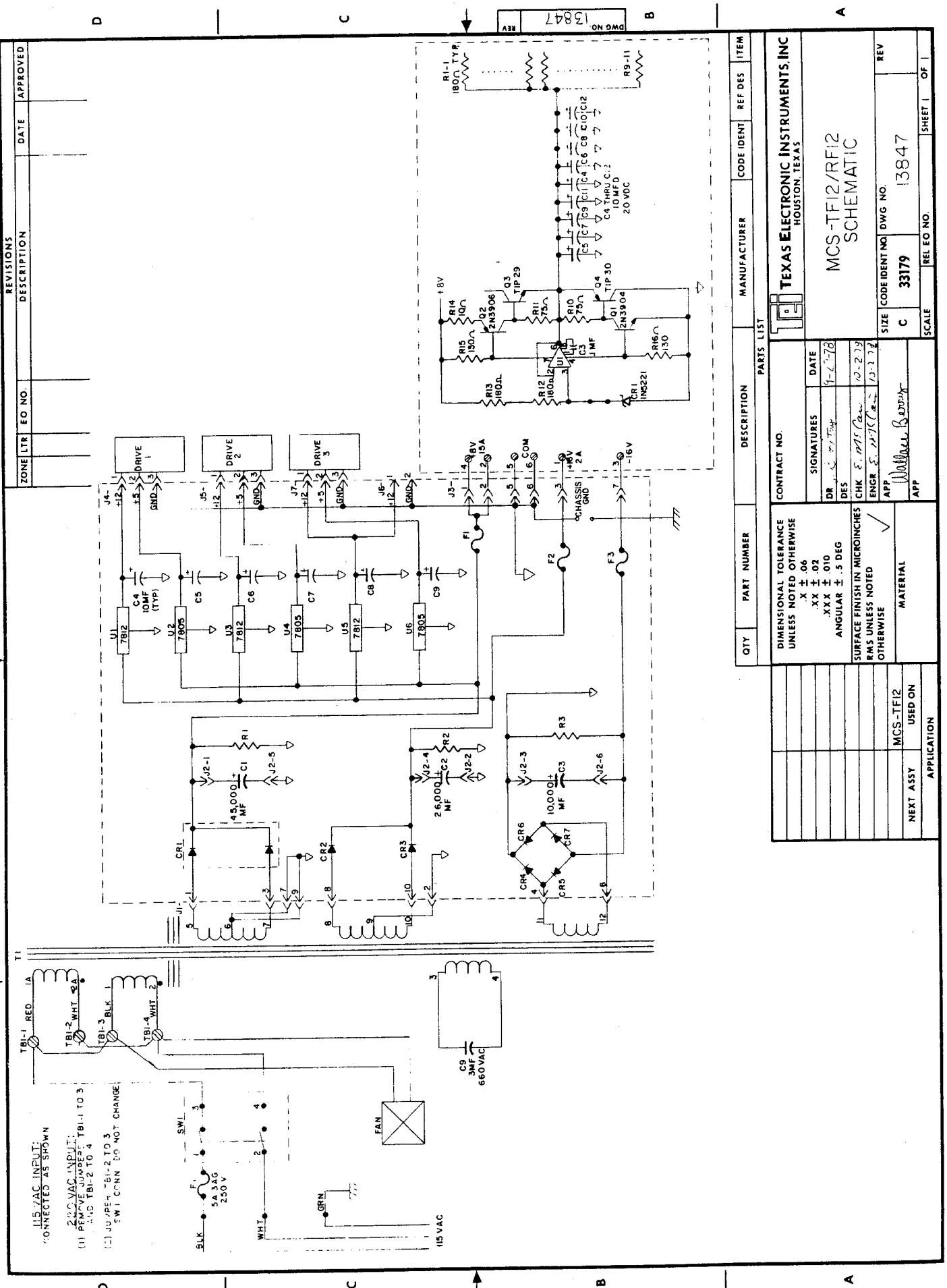


Figure 3-6 TF-12/RF-12 Schematic Diagram (Drawing 13847)

3.3.3 TF-12/RF-12 (Figure 3-6)

3.3.3.1 **AC Input**

This circuit is similar to the AC circuitry in Figure 3-4, except that the CVT capacitor is C9.

3.3.3.2 **13710 Motherboard**

The 13710 Power-Supply Motherboard is used in the TF-12 and RF-12 equipments.

+8 VDC Supply. The +8 VDC supply uses full-wave diode module CR1, filter capacitor C1, and bleeder resistor R1. This supply is fused at 20 amperes by F1.

This supply also drives integrated-circuit voltage regulators U2, U4, and U6, each of which supplies +5 VDC at 1 ampere for associated, customer-supplied, diskette drives.

+16 VDC Supply. The +16 VDC supply uses discrete diodes CR2 and CR3, connectd as a full-wave rectifier, filter capacitor C2, and bleeder resistor R2. This supply is fused at 2 amperes by F2.

This supply also drives integrated-circuit voltage regulators U1, U3, and U5, each of which supplies +12 VDC at 1 ampere for associated, customer-supplied, diskette drives.

-16 VDC Supply. The -16 VDC supply uses CR4-CR7 connected as a bridge rectifier, filter capacitor C3, and bleeder resistor R3. F3 fuses the -16 VDC supply at 2 amperes.

3.3.3.3 **13260 S-100 Bus Motherboard**

The S-100 Bus Motherboard has the active termination logic described in Section II.

TABLE 4-1
MICROFRAME REPAIR GUIDE

PROBLEM	POSSIBLE CAUSE	REPAIR
Power switch indicator doesn't light	Dead outlet	Check breaker, etc.
	Line cord bad or unplugged	Turn Power switch off, check, or plug in.
	F1 on rear panel	Section 4.2.1
	Switch	Section 4.2.2.5
	Fuseholder	Section 4.2.2.6
Indicator lights, nothing works	Fuses on motherboard	Section 4.2.2
	Any power supply voltage incorrect	Section 4.2.2
	Faulty S-100 Bus card	Card Documentation
Erratic computation	Card contacts	Section 4.2.3
	Inadequate or faulty line drivers	Section 4.2.4
	Active termination logic	Section 4.2.5
	Overheating	Section 4.2.6

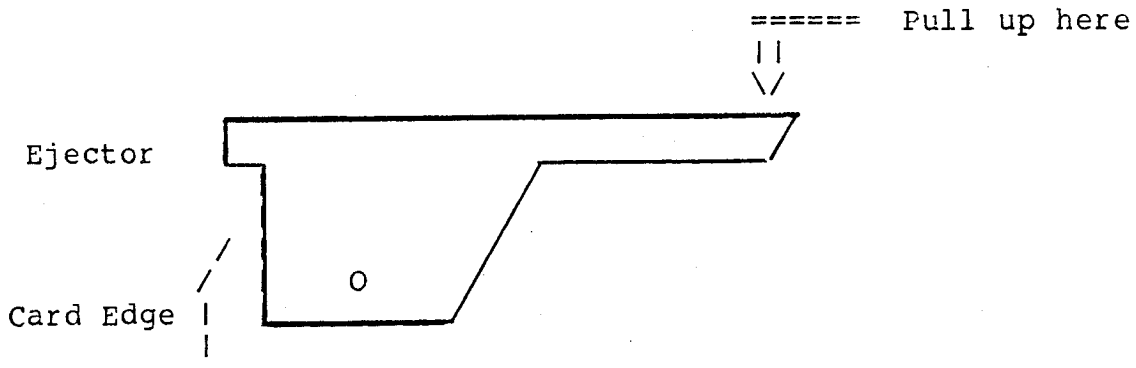


Figure 4-1 S-100 Bus Card Ejector

SECTION IV

MAINTENANCE AND REPAIR

4.1 MAINTENANCE

Your TEI, Inc. MicroFrame was constructed with industrial-quality, solid-state components that need little maintenance.

In an office environment, check the following items every 6 months. In an industrial environment, check every 3 months.

1) Power-supply fan filter. If dirty, clean with soap and water, or replace. Refer to Section 4.2.6.1 for procedure.

2) Tightness of screw terminals securing leads from power supply.

3) S-100 bus voltage levels.

4.2 REPAIR

This Section describes repair procedures for members of the TEI MicroFrame family.

4.2.1 LINE FUSE

To replace the line fuse, follow this procedure:

1) Open drive doors, if computer system has diskette drives.

2) Turn off power.

3) Unplug line cord.

4) Remove cover (MCS, TF) by removing two screws on each side or remove top (Rf, RM) by removing all screws from top.

5) Unplug each computer card by lifting up on both card ejectors (Figure 4-1) at the same time.

6) Remove fuse cap by pressing it in, then turning it counter-clockwise.

7) Unless obviously bad (discolored, broken, etc.), check fuse with continuity tester or ohmmeter.

8) Replace open fuse with good fuse of same rating. **NEVER OVERFUSE!**

9) Install replacement fuse by placing fuse in fuse cap, lining up tabs on fuse cap with slots in fuseholder, then pressing fuse cap into fuseholder and turning cap clockwise.

10) Turn power back on. If replacement fuse opens, go to step 14.

11) Turn power off and press cards back into sockets.

12) Turn power on. If replacement fuse opens, go to step 15.

13) If replacement fuse holds, try out computer operation.

14) If replacement fuse opened in step 10, follow this procedure:

    A) Turn power off, then remove power connections from S-100 Bus Motherboard.

    B) Replace fuse, turn power back on. If fuse holds, check motherboard for obvious short circuits, debris, etc. If none, reconnect power leads one at a time (power off before each, please). Check in circuit that causes fuse to open for such things as shorted filter capacitor, power semiconductors shorted to chassis, etc.

    C) If fuse opens in step B, turn power off, disconnect one lead of CVT capacitor (Section 4.2.2.3), then check across capacitor with ohmmeter on highest resistance scale.

    D) If capacitor OK, check fan wiring, fan motor, etc., for short circuit.

15) If replacement fuse opened in step 12, follow this procedure:

    A) Turn power off, replace fuse, then replace cards one at a time, turning system on after each replacement.

    B) If fuse opens, check last card installed for problems.

    C) If problem remains, refer to Section 4.3.

16) Replace cover or top.

4.2.2 POWER SUPPLIES

With power off, check for loose connectors, broken, burned, or discolored parts, and open fuses. If you see no obvious problem, you can replace the entire board as described below, or refer to Section 4.3 for further help.

4.2.2.1 **Fuses**

1) Visually inspect each fuse for open link, discolored, burned, or broken body, etc.

2) If available, check fuse with ohmmeter or continuity tester (open diskette-drive doors and turn power off first!).

3) To replace fuse, follow this procedure:

A) Remove fuse from fuse clips. If any corrosion present, clean with knife blade or fine sandpaper.

B) Replace open fuse with good fuse of same rating. **NEVER OVERFUSE!**

C) Install replacement fuse in fuse clips. Remove fuse and squeeze clips **gently** with pliers if fuse seems loose.

D) If replacement fuse opens, refer to Section 4.3.

4.2.2.2 Power-Supply Board Replacement

1) MCS-112/RM-12

1) Turn power off.

2) Remove any cards in last six motherboard slots.

3) Remove power-supply wiring from power-supply terminals.

4) Unplug transformer connector.

5) From underneath, remove screws securing power-supply board to chassis.

6) Tip board out.

7) Installation reverse of removal.

2) MCS-122/RM-22

1) Remove power-supply wiring from power-supply terminals.

2) Unplug J1.

3) From underneath chassis, remove screws holding power-supply board to chassis.

4) Rotate board to clear card cage, then remove board.

5) Installation reverse of removal.

3) RF-12/TF-12

1) Remove screws from underneath chassis. Note flat and lock washers.

2) Unplug connectors from board. Note what goes where.

3) Installation reverse of removal.

4.2.2.3 **Capacitor Replacement**

1) Filter Capacitor(s) (Round)

1) Be sure power off for at least 2 minutes.
2) Remove screws holding leads to capacitor terminals.
3) Loosen screw holding capacitor in bracket.
4) Remove capacitor.
5) Installation reverse of removal. Be sure to connect red lead to (+) terminal, black lead to (-) terminal.

2) CVT (AC) Capacitor (Rectangular)

1) Be sure power off.
2) Unplug line cord.
3) Remove rubber boot.
4) Disconnect leads (purple). Be sure to leave boot on leads.
5) Loosen screws for capacitor hold-down clips.
6) Remove capacitor.
7) Installation reverse of removal. Capacitor is not polarized, so each lead can be connected to the most convenient terminal. Be sure to slide boot back over terminals.

4.2.2.4 **Transformer**

1) Remove leads from connector on transformer.
2) Remove connector from transformer.
3) Remove purple wires from CVT capacitor (Section 4.2.2.3).
4) From underneath, remove screws holding CVT to chassis.
5) If applicable, remove screws holding CVT to interior support.
6) Installation reverse of removal. Be sure to tighten screws securely and replace rubber boot on CVT capacitor.

4.2.2.5 **Power Switch**

1) Be sure power off.

2) Unplug line cord.

3) Remove each push-on connector from switch by grasping connector, then gently pulling and wiggling the connector at the same time. Pliers may be required. **Never pull on wire!**

4) Push switch out from back of panel.

5) Installation reverse of removal. Be sure push-on connectors fit tightly.

4.2.2.6 **Fuseholder**

1) Be sure power off.

2) Unplug line cord.

3) Remove each push-on connector from fuseholder by grasping connector, then gently pulling and wiggling the connector at the same time. Pliers may be required. **Never pull on wire!**

4) Unscrew large nut securing fuseholder to panel.

5) Installation reverse of removal. Do not overtighten large nut.

4.2.3 S-100 MOTHERBOARD

With power off, check for loose connectors, broken, burned, or discolored parts, etc. If you see no problem, you can replace the entire motherboard as described below, or refer to Section 4.4 for further help.

1) Turn Power off.

2) Remove signal and power cables as applicable from cards; then unseat each card from its socket by lifting up on inside edge of both ejectors (Figure 4-1), then remove each card.

3) In a similar manner, remove front-panel connection, if applicable.

4) Remove power-supply wiring from motherboard terminals.

5) From underneath, remove screws securing motherboard to chassis. Again, note washers.

6) If necessary, turn MicroFrame on its side and remove screws holding card cage to chassis. Note washers.

7) Installation reverse of removal. Be sure to use flat and lock washers as per original assembly. Be sure to tighten power-supply leads securely.

4.2.4 CARD CONTACTS

With power off, unseat cards by lifting up on outside edge of both ejectors (Figure 4-1) at the same time. Carefully remove any signal cable(s), then remove card from socket and **gently** rub each card edge-connector contact with an ordinary eraser (not a power eraser or an art-gum eraser).

4.2.5 LINE DRIVERS

Each S-100 bus signal-input termination resistor is 180 ohms. This requires, at the +2.4 VDC level set by the active-termination logic, that line drivers be able to sink at least 13 mA.

Any S-100 Bus card with driver devices such as 7404, 74H04, 74S04, 74LS240, etc., that have I_{OL} specified as $\geq$ 13 milliamperes should work. S-100 Bus cards with line drivers such as 74L04 or 74LS04 that cannot meet this specification may not work in a TEI MicroFrame.

4.2.6 OVERHEATING

Your MicroFrame was designed to operate 24 hours a day, 7 days a week at the current levels stated in Section 1.4. If the MicroFrame appears to overheat, check the following items:

1) Overload. Check sum of card currents from card documentation against MicroFrame specifications.

2) Fan filter. Service (Section 4.2.6.1) if required.

3) Fan. Replace (Section 4.2.6.2) if required.

4) Transformer taps (Section 4.2.6.3).

Refer to Section 4.3 if further help required.

4.2.6.1 **Filter Service**

1) Remove four screws, then remove filter housing, grills, and filter.

2) Wash filter under running water, let dry, then place filter between grills in housing, and refasten housing to chassis with four screws.

4.2.6.2 Fan Replacement

1) Be sure power off.

2) Unplug line cord.

3) Remove nuts and bolts securing fan to panel.

4) If wires plug into fan, unplug, plug into new fan, then perform step 6 below.

5) If wiring attached to fan, unravel fan wiring from harness as required and disconnect fan from gang connector on Transformer.

6) Mount replacement fan with nuts, bolts, and lock washers, with corner having wiring nearest to wiring harness. Be sure to mount fan so that airflow is into the cabinet.

7) If necessary, work fan wires into harness, and connect to gang connector.

4.2.6.3 Transformer Tap

On 22-slot MicroFrame components only, transformer has both regular and higher-voltage taps for +8 VDC (nominal) supply. Overheating can result if higher voltage tap used with light current load.

Refer to Section A.3.

4.3 FOR FURTHER HELP

Contact:

APPENDIX A

INSTALLATION

A.1 UNPACKING

A.1.1 GENERAL

Your TEI, Inc. MicroFrame was carefully packed to insure safety during shipment. A sheet attached to the carton requested inspection for possible freight damage. If you have not already done so, please inspect the carton at this point. Note any signs of damage on bill of lading for possible claims.

Also, any equipment roughly handled or dropped should be so-noted on the bill of lading even though no damage is apparent at the time , so that damage discovered later can be claimed. TEI, Inc. cannot assume liability for freight damage.

A.1.2 PROCEDURE

Carefully unpack the MicroFrame. Save all packing material until installation complete.

A.2 INSPECTION

Inspect each System component for physical damage. Report any such damage immediately to the carrier and to your dealer.

A.3 CHECKOUT

Follow this procedure to check MicroFrame for proper operation.

1) Be sure equipment unplugged, then remove cover (MCS or TF-12; two screws each side) or top (RF or RM; screws on top).

2) Check transformer input connections against table A-1 for proper voltage connection.

TABLE A-1
TRANSFORMER INPUT CONNECTIONS

	TB1-1	TB1-2	TB1-3	TB1-4
For 115 VAC, connect to	TB1-3 SW1-3	TB1-4	TB1-1 Fan	TB1-2 Fan SW1-4
For 230 VAC, connect to	SW1-3	TB1-3	TB1-2 Fan	SW1-4

TABLE A-2
MCS-122, RM-22 8-VDC TRANSFORMER CONNECTIONS

CURRENT OUTPUT	CONNECTION
High	5A to J1-10
	7A to J1-12
	8A to J1- 9
	10A to J1-11
Low	5 to J1-10
	7 to J1-10
	8 to J1- 9
	10 to J1-11

3) With power switch off, plug line cord into AC socket. For International applications, it may be necessary to remove the furnished line plug and install an appropriate local device.

4) Press Power switch to light indicator in switch. If indicator does not light, refer to Section IV.

5) With DC voltmeter, check for +8 VDC to +11 VDC between pin 1 (+) and pin 50 (-, Ground) on any connector on motherboard. Pin 1 is nearest front left corner. Pin 50 is nearest front right corner.

6) Move (+) lead to pin 51 (directly behind pin 1)and check for +8 VDC to +11 VDC.

7) Move voltmeter (+) lead to pin 2 and check for +16 VDC to +18 VDC.

8) Move voltmeter (+) lead to pin 50, (-) lead to pin 52, and check for -16 VDC to - 18 VDC.

9) Move (-) lead back to pin 50. Move (+) lead to pin 75, then to pin 100. Neither pin should show any voltage reading.

10) Run (+) lead up and down remaining pins. Each should read about +2.4 VDC.

11) As discussed in Section 3.3.2, MCS-122 and RM-22 MicroFrames have alternate transformer secondary connections for the +8 VDC supply. Using the full secondary winding gives about 0.9 VAC more at the rectifier input than using the winding taps. Units manufactured before 1 June 1981 normally were connected for the higher voltage output; units manufactured since that time are connected for the lower voltage (but higher current) output.

12) To check or change the 22-slot transformer connection, remove top (MCS, Section 4.3) or side (RM) for access to the wiring. To change from high current to low current, rewire (Table A-2), then insulate unused leads with heat-shrinkable tubing, silicone rubber, etc. **Tape alone is not satisfactory!** It is best to change only one wire at a time.

13) To change from low current to high current, remove the tubing **and** the insulation from these leads, then rewire the cable, and insulate the unused leads as described above.

A.4 CARD INSTALLATION

CAUTION! TURN POWER OFF BEFORE PERFORMING THIS STEP. NEVER INSTALL OR REMOVE CARDS WITH POWER ON!

Note: It may be more convenient to install rack-mounted Mainframes into rack before card installation. Refer to Section A.5.

1) Visually inspect each card before installation for physical damage, jumper connections, switch settings, etc. Refer to documentation accompanying card.

2) Any card will work in any card slot; subject to physical considerations, such as signal cabling. S-100 Bus front-panel, if used, plugs into socket nearest MicroFrame front panel.

3) Slide card into card guides, then press firmly into MicroFrame socket. Note that card edge-connector offset prevents plugging card in backwards.

4) After cards installed, plug in signal cables as required. You can route signal cables into the Mainframe through the rear-panel slots, or between the cable clamp and the upper rear part of the back panel. If clamp used, tighten the screws holding it after cable installation.

5) Press Power switch on.

6) Pressing MicroFrame pushbutton switch should cause System reset.

A.5 MECHANICAL INSTALLATION

A.5.1 RF, RM SERIES

The following is a general procedure for installing RF/RM series equipments in standard 19" racks.

1) Each slide (Figure A-1) attached to the MicroFrame consists of three telescoping pieces: Inner U-channel (Item 1), middle channel (Item 2), and outer U-channel (Item 3). The inner channel bolts to the MicroFrame, the middle slide does the motion, the outer channel secures the MicroFrame to the rack.

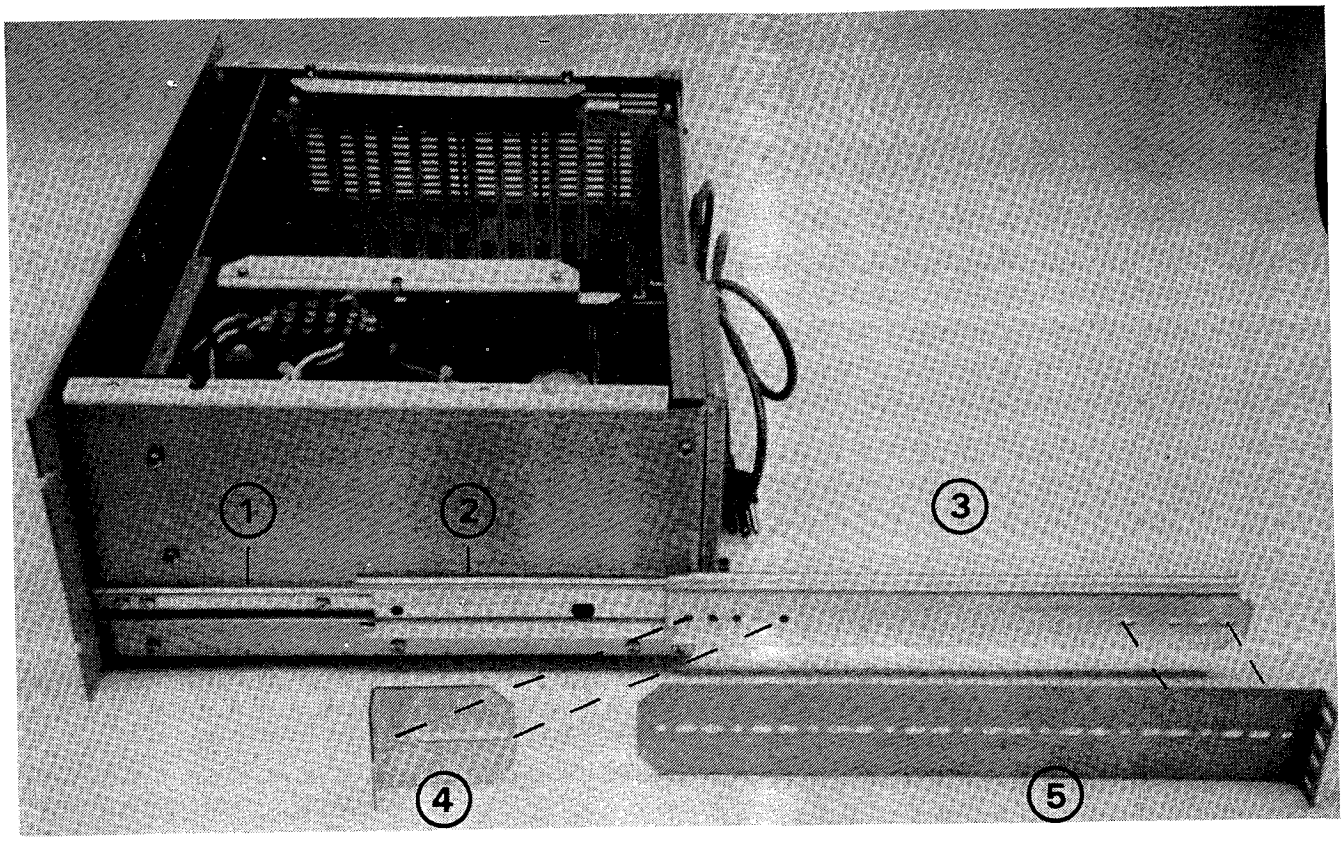


Figure A-1 MicroFrame Mainframe Rack Mounting

2) If the rack is no deeper than than the MicroFrame, and holes on the rack match any set of holes on the outer slide channel, then bolt the the slide directly to the rack. If the rack is deeper than the MicroFrame, or if no holes match, then use the furnished slide-extender brackets.

3) If needed, the long brackets (Figure A-1, Item 5) go to the rear, with the short side fastening to the rear internal vertical brace or to the rear of the rack; and the long side on the inside of the rack pointing toward the front. Fasten to rack with 8-32 hardware.

4) Attach short brackets (Figure A-1, Item 4) to MicroFrame slide as follows (dashed lines in Figure A-1):

   A) Place Mainframe on bench.

   B) Extend slide until access hole in middle slide aligns with front hole in outer channel.

   C) Insert 8-32 pan or binder-head screw through access hole in middle slide and through front hole in outer slide channel, then fasten bracket to outer channel by passing screw through single hole on long end. Secure with 8-32 nut, lock washer, and flat washer, but do not tighten firmly yet. Short end of bracket points away from MicroFrame.

   D) Move slide until access hole in middle slide aligns with rear hole in outer slide channel, then insert 8-32 pan or binder screw through access hole in middle slide, then through rear hole in outer slide channel, then through slot in bracket. Secure bracket with 8-32 hardware.

   E) Tighten screws firmly. Be sure bracket slot aligns with slide centerline.

   F) In a similar manner, install the bracket on the other side of the Mainframe.

5) With helper, place MicroFrame in rack at desired height and fasten front panel snugly, but not tightly, to rack with screws through front-panel slots.

6) With helper supporting rear, extend slide on one side until holes in rear of slide align with some set of holes in longbracket.

7) Quickly install 8-32 screws from inside of outer slide channel through holes in bracket, then secure with 8-32 nuts, lockwashers, and flat washers. Do not tighten fully yet.

8) Extend other slide, align, and fasten to bracket. Tighten all nuts firmly.

9) Remove screws holding front-panel to rack. Check installation by sliding MicroFrame in and out several times. Action should be smooth, with both sides moving at the same time. If not, check alignment. Reposition if necessary.

10) Slide MicroFrame out until it clears rack, then grasp front panel on either side, and try to move MicroFrame from side to side. It should move only very slightly. If much motion, slide is bad or equipment is not properly secured to brackets or brackets are not properly secured to rack or cabinet needs more bracing.

A.5.2 DRIVE INSTALLATION (RF-12, TF-12 only)

1) Install drive mounting plate (Figure A-2) with 6-32 hardware from beneath chassis. Be sure that slots on flat plate match cutout holes in chassis.

2) Refer to drive documentation and configure drive(s) for proper System designation: "A", "B", etc.

3) Insert drive(s) into front-panel cutout. Door-release button normally goes to the right.

4) Connect DC power cable(s) to drive(s). Refer to drive documentation for proper connector.

5) Connect signal cable(s) to drive(s).

6) Working through cutouts in chassis bottom, fasten each drive loosely to drive-mounting plate with 6-32 screws, flat washers, and lock washers. Press each drive bezel firmly against Micro-Frame front panel, then tighten mounting screws.

7) Install front panel blanking plate(s), if required.

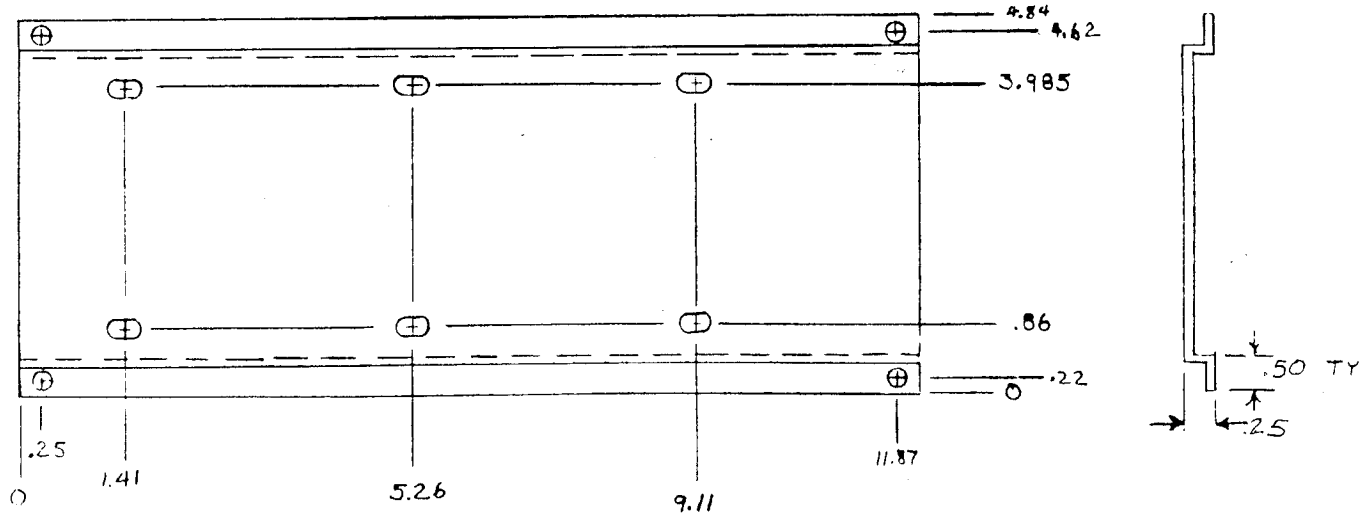


Figure A-2 Drive Installation

APPENDIX B

ENGINEERING DRAWINGS

B.1 SCHEMATIC DIAGRAMS

Figure 3-4 is schematic drawing 13154-00 for the MCS-112 and RM-12 MicroFrame Mainframes. Figure 3-5 is schematic drawing 13232-00 for the MCS-122 and RM-22 MicroFrame Mainframes Figure 3-6 is schematic drawing 13847 for the TF-12 and RF-12 MicroFrame Mainframes.

B.2 ASSEMBLY DRAWINGS

This appendix contains the following assembly drawings:

13120 (MCS-112/RM-12 power-supply board layout)
13130 (MCS-122/RM-22 power-supply board layout)
13138-01 (MCS-112, 50 Hz), 13138-02 (MCS-112, 60 Hz)
13195-01 (MCS-122, 50 Hz), 13195-02 (MCS-122, 60 Hz)
13610-00 (22-slot S-100 Motherboard)
13620-00 (12-slot S-100 motherboard)
13667-00 (RM-22)
13710 (RF-12/TF-12 power-supply board)
13745 (RM-12)
13761-01 (TF-12/RF-12, 50 Hz), 13761-02 (TF-12/RF-12, 60 Hz).

For convenience, drawings 13120, 13130, and 13170 appear in Section B.3 with the associated parts lists. The other drawings begin on page B-9.

B.3 PARTS LISTS

B.3.1 TOP ASSEMBLIES

Table B-1 shows the top assemblies.

TABLE B-1
MICROFRAME TOP ASSEMBLIES PARTS LIST

DESIG	DESCRIPTION OF MICROFRAME	P/N
MCS-112	12-slot, Table-top, 50 Hz	13138-01
MCS-112	12-slot, Table-top, 60 Hz	13138-02
MCS-122	22-slot, Table-top, 50 Hz	13195-01
MCS-122	22-slot, Table-top, 60 Hz	13195-02
RF- 12	12-slot, Rack, Drives, 50/60 Hz	13761-00
RM-12	12-slot, Rack, 50/60 Hz	13745-00
RM-22	22-slot, Rack, 50/60 Hz	13667-00
TF-12	12-slot, Table-top, Drives, 50/60z	13761-00

B.3.2 CHASSIS-MOUNTED COMPONENTS

B.3.2.1 **MCS-112/RM-12 MicroFrame Mainframes**

Table B-2 shows the components.

TABLE B-2
MCS-112/RM-12 CHASSIS-MOUNTED COMPONENTS

REF DES	DESCRIPTION	TEI P/N
PCB2	Motherboard, 12-Slot(1)	13620
PCB1	Power Supply(2)	13120
T1	Transformer (112-60Hz)	13128-02
T1	Transformer (RM12-60Hz)	13128-02
T1	Transformer (112-50Hz)	13602-02
T1	Transformer (RM12-50Hz)	13602-02
C4	Cap, 3 uF 660 VAC	1543-006
PCB1-J1	Socket Housing, 8 Ckt	2122-011
PCB2-J1	Socket Housing, 2 Ckt	2122-021
Fan	Fan	2610-011
-	Filter, Fan	13146-00
SW1	Power Switch	5113-001
SW2	Reset Switch	5114-005
F1	Fuse, 5A 250V, 3AG	5173-062
-	Power Cord	6080-008
-	Boot, Capacitor	1592-003

(1) Section B.3.3
(2) Section B.3.4

B.3.2.2 **MCS-122/RM-22 MicroFrame Mainframe**

Table B-3 shows the components.

TABLE B-3
MODELS MCS-122/RM-22 CHASSIS-MOUNTED COMPONENTS

REF DES	DESCRIPTION;	TEI P/N
PCB2	Motherboard 22 Slot(1)	13610-00
PCB1	Power Supply(2)	13130-00
T1	Transformer (122-60Hz)	13214-02
T1	Transformer (RM22-60Hz)	13214-02
T1	Transformer (122-50Hz)	13575-02
T1	Transformer (RM22-50Hz)	13575-02
C4	Cap, 5 uF 660 VAC	1543-001
PCB1-J1	Socket Housing, 12 Ckt	2122-013
PCB2-J1	Socket Housing, 2 Ckt	2122-021
Fan	Fan	2610-011
-	Filter, Fan	13146-00
SW1	Power Switch	5110-001
SW2	Reset Switch	5114-011
F1	10A, 250V, 3AG	5173-079
-	Power Cord	6080-008
-	Boot, Capacitor	1592-003
-	Card Guide	1750-004

(1) Section B.3.3
(2) Section B.3.4

B.3.2.3 **TF-12/RF-12 MicroFrame Mainframe (13761)**

Table B-4 shows the components.

TABLE B-4
TF-12/RF-12 CHASSIS-MOUNTED COMPONENTS

REF DES	DESCRIPTION	TEI P/N
PCB2	Motherboard, 12-Slot(1)	13620
PCB1	Power Supply(2)	13710
T1	Transformer (112-60Hz)	13128-02
T1	Transformer (RM12-60Hz)	13128-02
T1	Transformer (112-50Hz)	13602-02
T1	Transformer (RM12-50Hz)	13602-02
C1	Capacitor, 45000 uF 15 VDC	1521-068
C2	Capacitor, 26000 uF 30 VDC	1521-070
C3	Capacitor, 10000 uF 30 VDC	1521-088
C4	Capacitor, 3 uF 660 VAC	1543-006
PCB1-J1	Socket Housing, 8 Ckt	2122-011
PCB2-J1	Socket Housing, 2 Ckt	2122-021
Fan	Fan	2610-011
-	Filter, Fan	13146-00
SW1	Power Switch	5113-001
SW2	Reset Switch	5114-005
F1	Fuse, 5A 250V, 3AG	5173-062
-	Power Cord	6080-008
-	Boot, Capacitor	1592-003

(1) Section B.3.3
(2) Section B.3.4

B.3.3 S-100 BUS MOTHERBOARDS

B.3.3.1 Standard Configurations

P/N	CAPACITY	SIZE (Inches, Centimeters)
13620	12 cards	8.50 (21.6) x 10.05 (25.52)
13610	22 cards	8.50 (21.6) x 17.50 (44)

B.3.3.2 Parts Lists

Table B-5 contains the parts lists for both motherboards.

TABLE B-5
MCS/RM S-100 BUS MOTHERBOARD PARTS LISTS

REF DES	P/N	DESCRIPTION	12 SLOT QTY	22 SLOT QTY
-	13621	Fab TEI	1	-
-	13611	Fab TEI	-	1
C3	1562-002	Cap .1 uF	1	1
C4-C12	1580-001	Cap 10 uF 20V	9	9
-	2122-020	2-Circuit Header	1	1
-	2125-011	100-pin Edge Conn.	12	22
U1	3100-017	748 MIL-SPEC	1	1
-	3190-002	IC Socket 8 pin	1	1
R14	4741-145	10 ohm, 1/4 W 2%	1	1
R10,R11	4741-229	75 ohm, 1/4 W 2%	2	2
R15,R16	4741-252	130 ohm, 1/4 W 2%	2	2
R12,R13	4741-266	180 ohm, 1/4 W 2%	2	2
R1,R9	4784-002	11-segment network 180 ohms	9	9
CR1	4840-026	IN5221	1	1
Q1	4864-005	2N3904	1	1
Q2	4864-007	2N3906	1	1
Q4	4873-011	TIP30	1	1
Q3	4874-035	TIP29	1	1

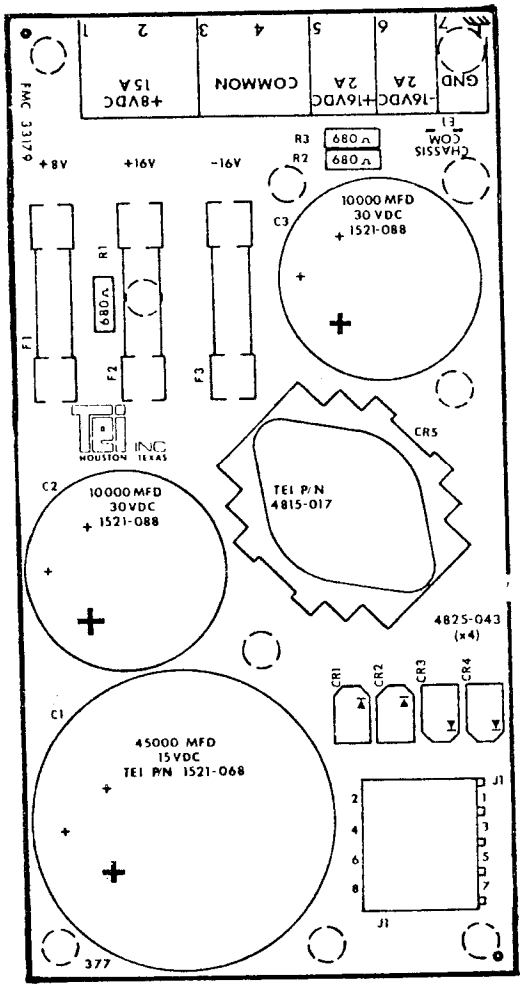


Figure B-1 13120 Power-Supply Board Layout

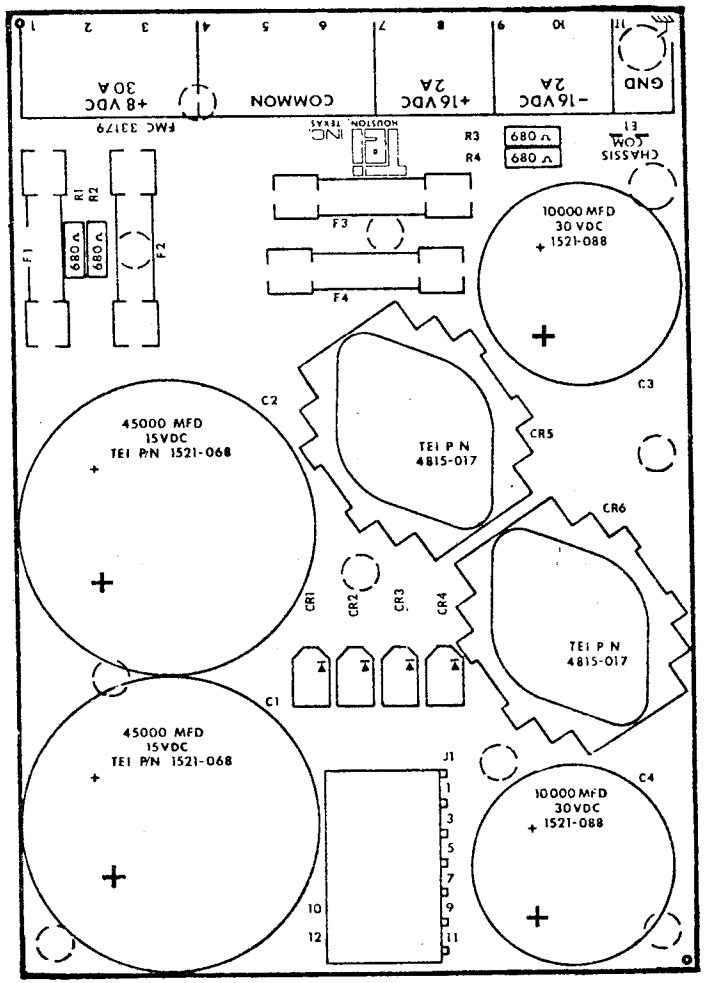


Figure B-2 13130 Power-Supply Layout

B.3.4 POWER SUPPLIES

B.3.4.1 **MCS-112/RM-12 (13120)**

Table B-6 contains the parts list for power-supply board 13120. Figure B-1 shows the layout.

TABLE B-6
MCS-112/RM-12 POWER SUPPLY PARTS LIST

REF DES	DESCRIPTION	TEI P/N
C1	45000 uF 15 VDC	1521-068
C2, C3	10000 uF 30 VDC	1521-088
CR1 - CR4	60S4	4825-043
CR5	R712	4815-017
E1	#20 Ga Jumper	6009-003
F1	20A, 32V, 3AG	5173-029
F2, F3	5A, 250V, 3AG	5173-022
J1	Pin Header, 8 Ckt	2122-005
R1 - R3	820 ohm 1/2 W 10%	4725-329
	Circuit Board	1781-106

B.3.4.2 **MCS-122/RM-22 Power Supply (13130)**

Table B-7 contains the parts list. Figure B-2 shows the layout.

TABLE B-7
MCS-122/RM-22 POWER SUPPLY PARTS LIST

REF DES	DESCRIPTION	TEI P/N
C1, C2	45000 uF 15 VDC	1521-068
C3, C4	10000 uF 30 VDC	1521-088
CR1 - CR4	60S4 Rectifier	4825-043
CR5, CR6	Rectifier, R712	4815-017
E1	#20 Gauge Jumper	6009-003
F1, F2	Fuse, 20A, 32V, 3AG	5173-029
F3, F4	Fuse, 10A, 32V, 3AG	5173-027
J1	Pin Header, 12 Ckt	2122-007
R1 - R4	680 ohm 1/2 W 10%	4725-321
	Circuit Board	1781-107

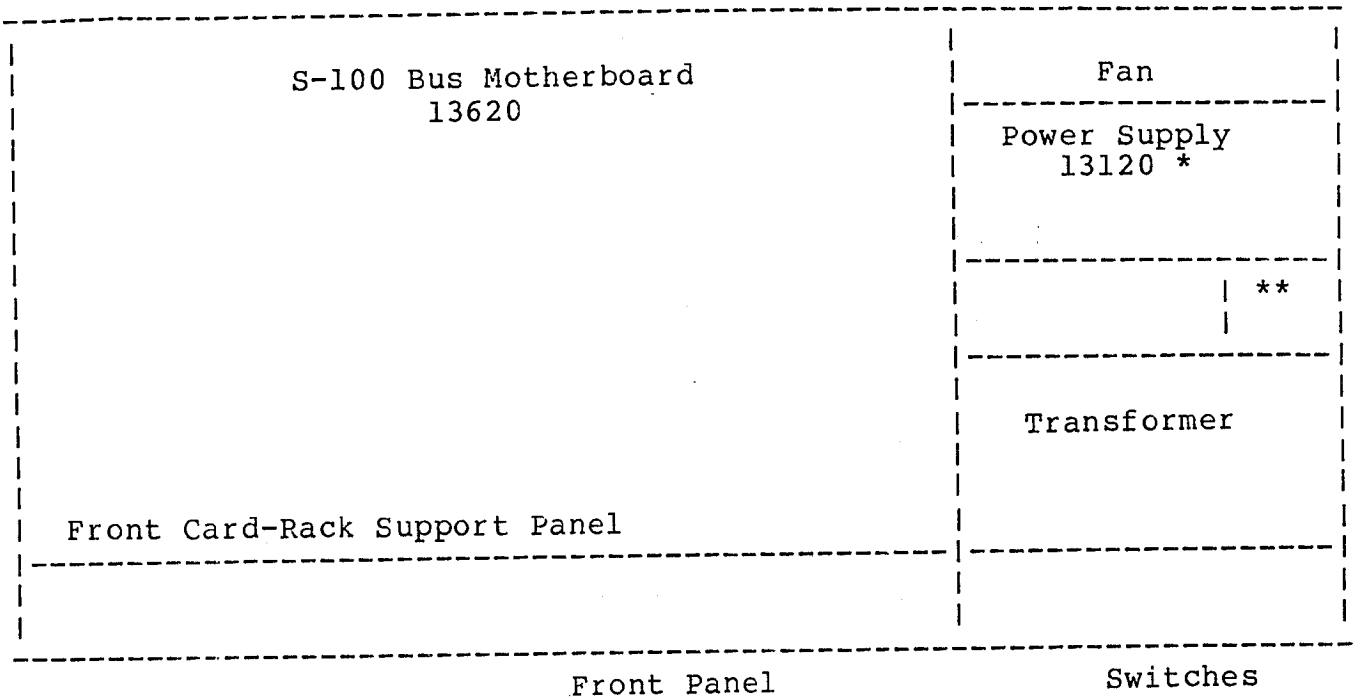
B.3.4.3 **RF-12/TF-12 Power Supply (13710)**

Table B-8 contains the parts list. Figure B-3 shows the layout.

TABLE B-8
RF-12/TF-12 POWER SUPPLY PARTS LIST

REF DES	DESCRIPTION	TEI P/N
C4 - C9	Capacitor, 10uF,20V	1580-001
CR1	Rectifier, R712	4815-017
CR2 - CR7	Rectifier, 60S4	4825-043
E1	#20 Gauge Jumper	6009-003
F1	Fuse, 20A, 32V, 3AG	5173-029
F2, F3	Fuse, 5A, 32V, 3AG	5173-022
J1	Pin Header, 10 Ckt	2122-006
J2	Pin Header, 6 Ckt	2122-004
J3	Pin Header, 8 Ckt	2122-005
J4,J5,J7	Pin Header, 3 Ckt	2122-025
J6	Not used	--------
R1 - R3	680 ohm 1/2 W 10%	4725-321
U1,U3,U5	Regulator, 7812	3120-007
U2,U4,U6	Regulator, 7805	3120-003
	Circuit Board	1781-115

Figure B-3 13710 Power-Supply Board Layout



* Power Supply in this location for MCS-112; further forward in RM-12.

** AC (rectangular) capacitor in this location for MCS-112; parallel with power supply board for RM-12

Figure B-4 MCS-112, RM-12 Assembly [13138-01 (MCS-112, 50 Hz), 13138-02 (MCS-112, 60 Hz), 13745, RM-12]

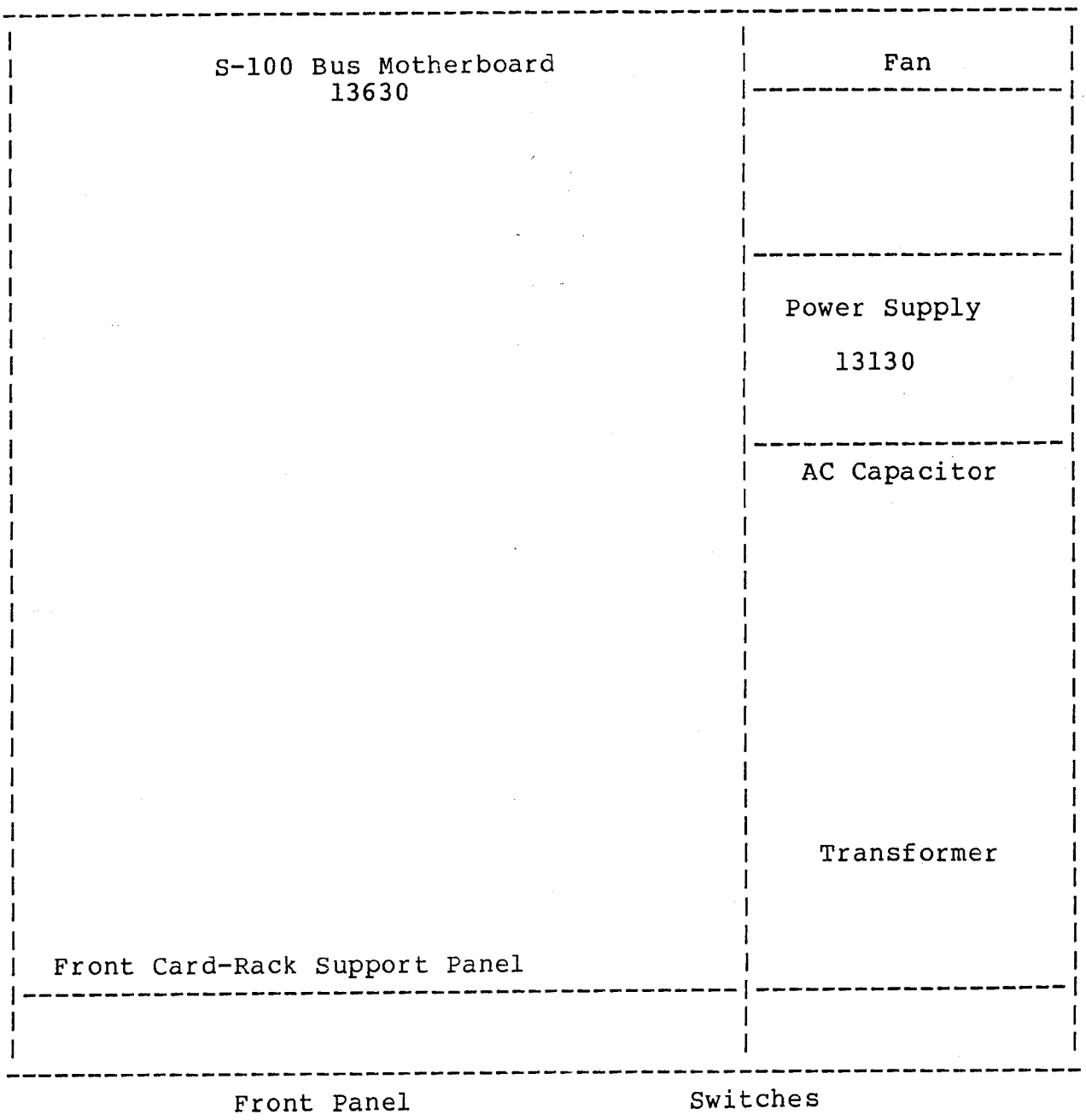
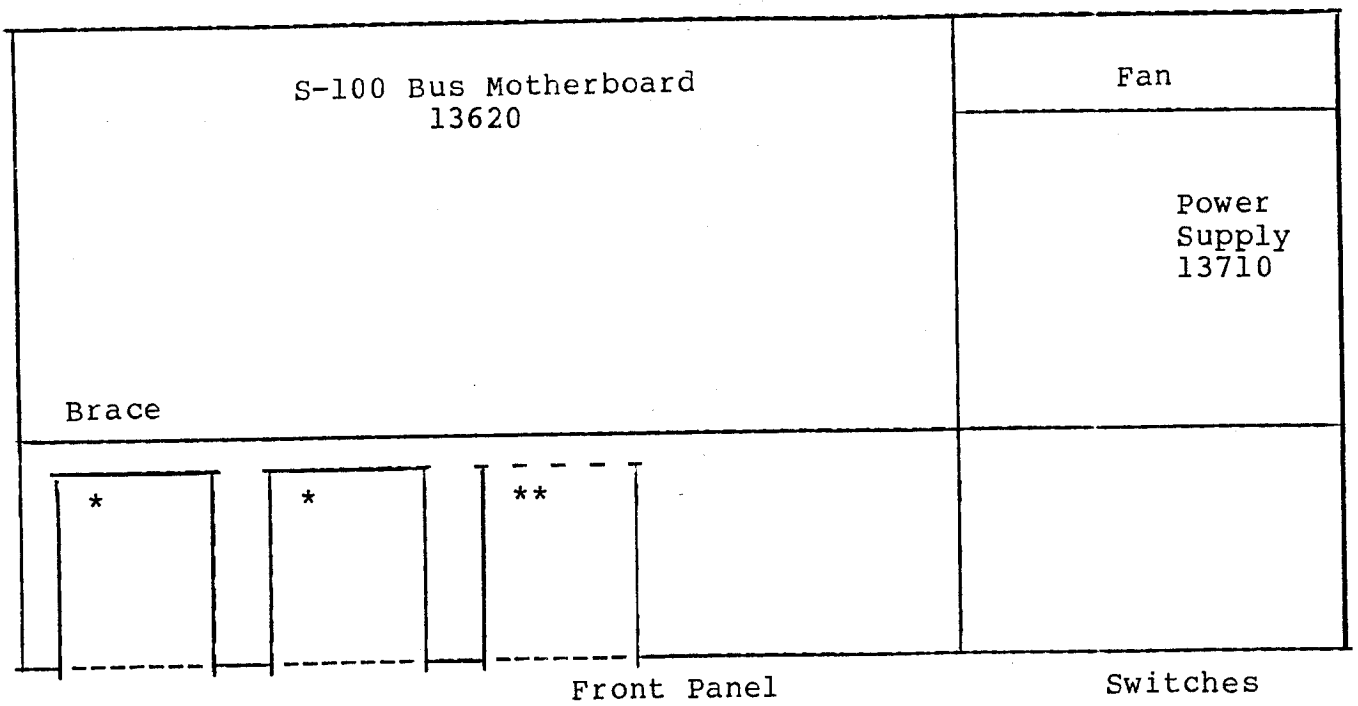


Figure B-5 MCS-122, RM-22 Assembly Drawing [13195-01 (MCS-122, 50 Hz), 13195-02 (MCS-122, 60 Hz); 13667-00, RM-22]



* Customer-supplied 5.25" drive
** Third drive mounting and power supply optional

Figure B-6 RF-12/TF-12 Assembly Drawing 13761-00

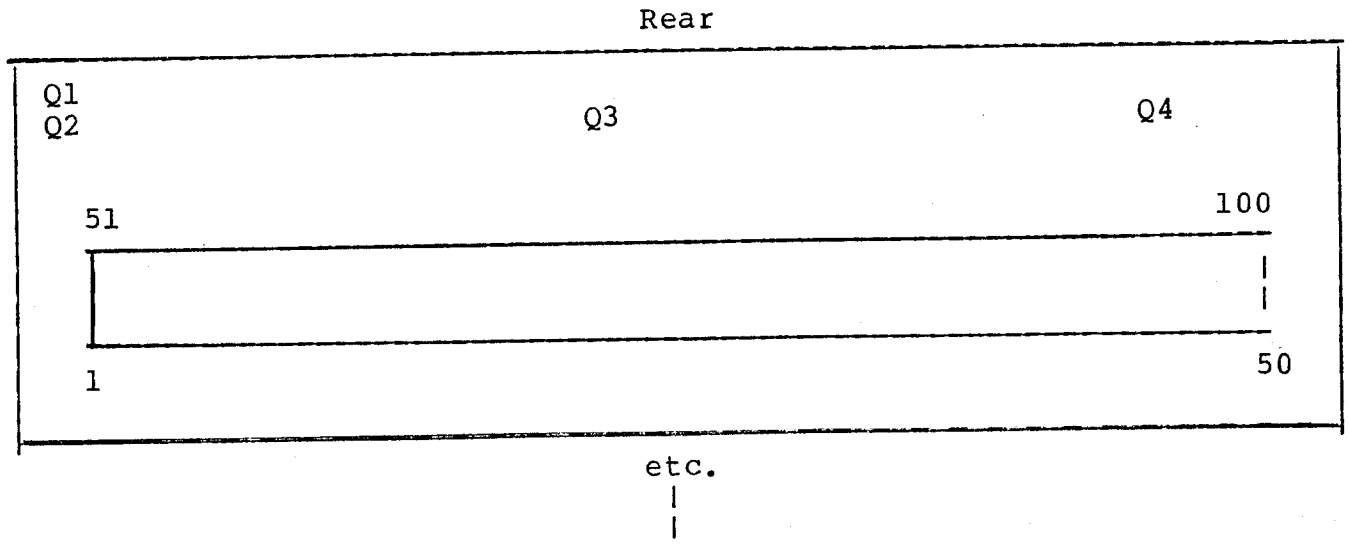


Figure B-7 S-100 Motherboard (13610-00,22-slot; 13620-00 (12-slot)